

Funding Open Infrastructure as a Public Utility: A Preliminary Investigation in Water Utility Funding

Authors

Asura Enkhbayar, Invest in Open Infrastructure, [0000-0002-3934-026X](tel:0000-0002-3934-026X)

Richard Dunks, Invest in Open Infrastructure, [0000-0001-6999-7935](tel:0000-0001-6999-7935)

Introduction

Our interviews with nine infrastructure service providers highlighted the need to address the issue of stable funding for infrastructure services. While providers have developed some successful strategies for funding their work, it became apparent in our research that each encountered difficulties and was searching for more stable and reliable sources of revenue to cover their operations in ways that met their particular needs, both in terms of their means of service delivery and the external environment in which they operated.

In working to understand how a stable and reliable model for funding open infrastructure in research and scholarly communication could be architected, IOI looked at how public utilities, in particular water utilities, are funded around the world. Drawing on some of the preeminent literature and guidance on the topic from widely respected organizations (the OECD, WHO, and IRC), we attempt below to highlight some key lessons for funding a robust infrastructure of open services. Key to this is understanding knowledge as a public good, like water, electricity, and natural gas, and the means by which these vital public goods are best funded for reliable, robust, and sustainable supply in the long term.

Water is an essential resource necessary for all life on Earth to flourish. As such, it is often described as a social good meeting a basic human need and existing as a human right, but it also exists as an economic good, being an input to various production processes and virtually every type of agricultural activity (Brikke & Rojas, 2001). Additionally, the transmission, treatment, and distribution of water requires investment in infrastructure to facilitate these activities, while the operation and maintenance of this infrastructure incurs costs that must be covered in order for water to flow to those who need it (McNeill, 1998). Balancing the social and economic aspects of water has led to work developing a sustainable cost recovery approach that

ensure communities are able to access water in a way that is sensitive to local needs and interests while still ensuring the costs for water supply is adequately funded so the infrastructure is robust, reliable, and sustainable (Brikke & Rojas, 2001).

The models presented below cover the key components of a sustainable cost recovery approach as a means to understand how similar conversations could be conducted when funding open infrastructure in research. As is clear from the research, no one funding source is prized above all others, but each (user fees, taxes, and contributions) has a particular place in funding water infrastructure as they do for funding research infrastructure. As the literature demonstrates, matching the funding source to the costs it best covers is key to building a sustainable funding model that ensures infrastructure is well funded now and into the foreseeable future.

Who's Working on This

The [Organisation for Economic Co-operation and Development](#) (OECD) is an intergovernmental economic organization with 38 member countries founded in 1961. While the overarching mission is to stimulate economic progress and trade, 15 directorates address and investigate specific areas of focus. The Environment Directorate's work on biodiversity, water and natural resources management focuses on policy analysis to help ensure more environmentally effective, cost-efficient, and equitable outcomes. Their research on financing sustainable WASH systems is particularly valuable for its insights into the importance and impact of international coordination of policies and values framework. In recent years, the OECD has been studying the value of combining both commercial and public funds to create sustainable water sanitation and supply.

The [World Health Organization](#) (WHO) is a specialized agency of the UN focused on global public health. As a critical component to human health and well-being, the WHO takes a particular interest in improving water, sanitation, and hygiene as both a direct and indirect way of addressing a host of public health issues, and has since its inception in 1948 (WHO, 2018).

The [IRC](#) is an international non-profit organization founded in 1968 that works on long-term solutions for global WASH services. Initially founded as the International Reference Center (IRC) on Community Water Supply under an agreement between the WHO and the government of the Netherlands, IRC gained importance during the UN's International Drinking Water Decade (1981-1990). Ever since, as a 'think and do tank' IRC has been offering consulting and advisory services as well as researching and developing resilient WASH systems in the world. Among its long history of contributions, their work on developing financial models for sustainable rural WASH

services funded by the Bill & Melinda Gates Foundation stands out. The work in this report heavily draws from the tools and methods developed during that project.

Important Lessons from the Research

Strategic Financial Planning

Recognizing the importance of a sound financial basis for providing water supply and sanitation, the OECD advocates for strategic financial planning (SFP) at the national and international levels as a “high-level multi-stakeholder policy dialogue process” necessary for meeting the Millennium Development Goals (MDG) based on an analysis of what infrastructure is needed for sustainable WASH services and how it can be afforded. As a methodology, SFP builds on a variety of tools to describe and understand financial flows, including as the 3Ts taxonomy of funding sources outlined below, as well as concrete guidelines for policy makers to evaluate and adjust public policy, including governance as a necessary precondition for sustainable financing¹ and managing costs as a means to realize the maximum potential from the available funding sources outlined in the report. (OECD 2009b)

Funding Sources: The 3Ts: Tariffs, Taxes, and Transfers

As previously mentioned, the OECD identified three “ultimate” sources of financial resources available to fund the needs of WASH services: tariffs, taxes, and transfers (3Ts). These three sources are the means by which the costs of running water infrastructure service is shared between users, the public, and private funders.

- **Tariffs** are financial contributions from the users of a service. In the case of WASH services, tariffs play a central role as they make up the biggest part of revenue across the globe that fund water supply and sanitation. With the provision of a public good such as water, affordability constraints and questions of social justice take on a central role in tariff setting and pricing mechanism. Therefore, governance structures and the values and principles of policy makers are essential to ensure equitable and just tariff-setting strategies that take into account not just the economic but the social costs involved in providing clean water and sanitation (OECD, 2009a, p. 79). Tariff structures not

¹ For more on IOI’s work on community-led governance in scholarly communication, see Moore, Samuel A. (2022). Community Governance In Scholarly Communication (Version 3). Zenodo. <https://doi.org/10.5281/zenodo.7035560> and Cline, Ravin, Hernandez Ortiz, Tania, & Dunks, Richard. (2022). Governance in Nonprofit Organizations: A Literature Review (2.2). Zenodo. <https://doi.org/10.5281/zenodo.7025611>.

only differ between countries but also between densely populated cities and rural regions. For instance, Libey et al. (2020) propose that tariffs should be further disaggregated by user types differentiating between individual users and institutional customers.

- **Taxes** are contributions to the costs of a service through fees collected at different levels of organization (local, regional, national, or even international) independent of the direct usage. Typically, these domestic taxes would be collected at the national level and funneled into the sector through subsidies, capital investments, or operations or other “hidden” forms such as tax rebates or subsidized services such as electricity to the water infrastructure providers.
- **Transfers** refer to financial support from charitable foundations (e.g., NGOs, philanthropies, or decentralized cooperation among local governments) and international donors. Very often these transfers come in the form of grants, guarantees, or concessionary loans (WHO, 2017). For the financing of WASH systems, Official Development Assistance (ODA) makes up a large proportion of these transfers and also has an important role for policy makers in the sector.

As the largest source of revenue to finance water supply and sanitation, tariffs play a central role in the financing of WASH services across the globe. This makes addressing social justice issues around affordability and accessibility challenging, particularly in light of the UN global development goals for water and sanitation (OECD, 2009a). Accordingly, a considerable amount of research has been done on various tariff structures (OECD, 2009a), appropriate strategies to price setting (Brikke & Rojas, 2001), and ways of subsidizing tariffs through taxes or transfers (OECD, 2019). Such detailed models are beyond the scope of this work but point to the great deal of work that’s been done to maintain equity in the process of covering the costs of providing a vital public good.

While tariffs are important to the operation of sustainable WASH systems, the OECD provides deeper analyses of how taxes and transfers can support strategic financial planning, including important investment in WASH systems to further their development. Taxes can be efficiently deployed to promote the consumption of merit goods, such as water and sanitation, as well as allow tariffs to rise gradually in the face of steep cost increases or permanently provide services below cost to deserving consumer groups (OECD, 2009b, p. 41), thus increasing access to those unable to pay the full cost of the water they consume.

The OECD also suggests that transfers might be especially effective at addressing and overcoming bottlenecks in the sector by supporting financial planning processes such as capacity building, advocacy, and coordination. Similar to taxes, transfers can also be used to ensure access to services by those with less financial means through tailored, targeted grant-delivery systems. Lastly, transfers can be specifically used to create sustainable funding sources by supporting the development and use of risk-management mechanisms that could help attract private funding (OECD, 2009b, p. 45).

Since their introduction by the OECD, 3Ts have become a common tool of researchers, analysts, and service providers alike in the water sector (WHO, 2017). Equipped with these tools of understanding the various means by which water infrastructure is financed, policymakers, funders, and service providers alike attempt to find the right mix of tariffs, taxes, and transfers for sustainable WASH services in various communities around the globe. However, various concerns have also been raised about the limitations of the methodology. For instance, the choice of the three words themselves have been scrutinized for a host of reasons, such as the implied narrow understanding of tariffs due to its use in common-language or the different use of transfers in India or Latin American countries. Additionally, the 3Ts framework neglects to include those users who self-supply by making “household investments” in order to provide for their needs (Danert & Hutton, 2020; WHO, 2017).

Funding Sources: Trackfin

To address these shortcomings, the WHO, as part of the UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water (UN-GLAAS) project, developed a methodology for identifying and tracking financing for water supply and sanitation as part of the TrackFin Initiative (WHO, 2017). As part of this initiative, the following financing types are described:

1. Tariffs (user fees for services provided)
2. Users' expenditure on self-supply
3. Domestic public transfers (central or local government subsidies from taxes and other government revenue, usually provided in the form of grants)
4. International public transfers (grants and voluntary donations originating from public donors outside the country, as well as multilateral agencies)
5. Voluntary contributions (donations and grants from both international and national non-governmental organizations, charities, civil society organizations, and individuals)

6. Repayable financing (all sources of financing requiring some form of repayment, including government-financed loans, guarantees, bonds, and other financial instruments)

This more nuanced system is helpful for better understanding the various financial flows that support the operation of WASH infrastructure beyond the simple 3Ts breakdown.

Cost Accounting: Life-Cycle Cost Approach

Building on their decades-long experience in water sanitation and supply, the IRC conducted a series of country studies to evaluate approaches to creating water sanitation and supply systems in rural regions. From this work, they developed a categorization of costs for designing, building, and maintaining WASH infrastructure (Fonseca et al., 2011). This list is as follows:

- *Capital expenditure (CapEx)* – investments to construct or purchase fixed assets
- *Operating and minor maintenance expenditure (OpEx)* – regular and ongoing expenses to cover ongoing operations, as well as recurring maintenance to keep systems operational
- *Capital maintenance expenditure (CapManEx)* – maintenance expenditures beyond minor recurring expenses on asset renewal, replacement, or rehabilitation
- *Cost of capital (CoC)* – financing costs associated with capital expenditures
- *Expenditure on direct support (ExpDS)*
- *Expenditure on indirect support (ExpIDS)*

The life cycle cost approach distinguishes between investment costs and recurring costs that relate to the initiation phase and ongoing phase of service delivery (Abrams et al., 1998). Furthermore, the approach shifts the attention to often underestimated and neglected costs such as expenditures for larger investments for maintenance of capital or expenditures for direct and indirect support structures to better understand recurring costs for the operation and maintenance of infrastructure. Each of these is discussed in more detail below.

Investment costs

- *Capital expenditure (CapEx)* is the capital invested in purchasing or developing fixed assets required to establish a new service including costs such as the acquisition of technology and tools, initial development of software, but also necessary one-off studies or associated training and consultation. Investments

of this kind are large and typically “lumpy” in their nature in contrast to other regular ongoing costs that tend to be more stable and consistent over time. CapEx is distinguished from other larger investments in their improvement of the quality or quantity of service delivery, expanding capacity and improving the ability of the organization to deliver the service.

Recurring costs

The second larger group of costs are the recurring costs of an ongoing service which can be further disaggregated into specific cost categories.

- *Operational and minor maintenance expenditure (OpEx)* are routine costs required to keep a service running. Operating costs include all recurrent expenditures that are required to provide the service including wages, bills, service fees, or any other regular purchase. Maintenance costs include the routine expenditures required to keep the underlying systems running with expected performance such minor fixes, updates, or technical maintenance of infrastructure. OpEx are therefore regular smaller costs that maintain the service delivery level.
- *Capital Maintenance Expenditure (CapManEx)* are occasional expenses required to keep service delivery at the designed level beyond the routine maintenance and repair costs. These larger expenditures usually are required to avoid system failure or to ensure future operability. CapManEx are therefore less frequent and more expensive than OpEx but do not change the service delivery level as CapEx do.
- *Cost of Capital (CoC)* is the cost of financing a service; i.e. the cost of accessing the funds needed to create and provide the service. This includes capital repayments and the cost of capital such as interest and fees on loans. Ideally, CoC should only be relevant for funds that were used to fund CapEx.
- *Expenditures for direct support (ExpDS)* include the cost of support activities directed to local-level stakeholders (the definition of local-level depends on the specific service), users, and user groups. IRC provides the example of user satisfaction surveys or handling complaints as costs that are often included as overhead in OpEx.
- *Expenditures for indirect support (ExpIDS)* includes the activities at the macro-level such as capacity building, policy, planning, and monitoring contributing to the larger sector while not targeting individual programmes or projects. These may include government-level development and regulatory frameworks, institutional arrangements, or capacity building for professionals and technicians in the sector.

The WHO borrows the life-cycle cost approach of the IRC in the TrackFin Initiative, modifying it into 6 categories of costs associated with water supply and sanitation (WHO, 2017). These include:

1. Investment costs (including hardware and associated support)
2. Operating and maintenance costs
3. Large capital maintenance costs
4. Financial costs
5. Support costs (also referred to as software costs)
6. Taxes

In both the IRC and WHO's formulation, the purpose of this work is to support sustainable cost recovery with a more nuanced understanding of the involved costs and recovery mechanisms. For instance, they distinguish between four different strategies to recover certain types of costs at different paces: (1) Immediate full cost recovery, (2) progressive full cost recovery, (3) recovery of recurrent costs only, and (4) the recovery of recurrent costs only with an initial use of subsidies (Brikke & Rojas, 2001).

Most importantly, however, the above mentioned strategies and scenarios describe pathways towards (or even versions of) financial sustainability depending on the delivered service and local context. In other words, financial sustainability becomes a conversation about the clarity and depth of the understanding of the financial planning involved in a service, rather than a set of particular organizational structures. As Cardone & Fonseca (2003) state on behalf of the IRC:

The crucial point is that unless all of the costs related to providing and maintaining a service (technical, human resource, institutional) are identified, organized, and covered in a coherent manner with sources of funds, a system cannot be considered to be sustainable. (p. 17)

Aligning Funding with Costs

As Cardone and Fonseca (2003) writing on behalf of the IRC make clear, the point of discerning funding sources and cost types is to match the funding source with the type of cost. Given that tariffs (user fees) generally flow into an organization on a regular basis, these are ideal for covering some or all of the recurring expenses, such as OpEx, CapManEx, and CoC, while the erratic and unpredictable nature of transfers (voluntary contributions) make them more suited to covering CapEx rather than OpEx. This isn't to say tariffs can't be used to cover a portion of investment expenses or transfers can't be used for covering some portion of the recurring expenses, but it's

in the long term interests of the organization not to rely on these sources for these types of expenses. CapEx can be delayed if there are some complications in receiving a grant or a fundraising effort fails to meet a target amount but OpEx can rarely be deferred without doing long-term damage to the organization's ability to deliver services and should therefore be covered by more reliable and consistent sources of funding to ensure the organization is meeting its financial obligations.

Conclusion

The discussion above is intended to help add additional nuance to the conversation about how to fund open infrastructure services. As is clear from the literature, there is no one "right way" to fund water infrastructure. While some of the ideas presented above have direct applicability to open infrastructure financing, such as the categories of funding and costs, there are likely areas where the example breaks down. Water is a tangible, ubiquitous commodity conducted through physical infrastructure that every human being, animal, and industry requires for survival and success. Knowledge doesn't have that benefit, making the awareness building and consciousness raising around the issues of stable, secure, and reliable financing a more challenging exercise than that for our aging water infrastructure.

Nevertheless, this exercise of discerning funding and costs is an important one as infrastructure services move beyond the model of short-duration projects to being full-fledged services scientists, researchers, librarians, and other stakeholders can have confidence will be able to provide reliable, robust, and valuable services now and for the foreseeable future. It is only on this foundation of sustainable financing that we can build an infrastructure of open services that can become the default in research.

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List of acronyms and abbreviations

3Ts - Tariffs, taxes, transfers

CapEx - Capital expenditure

CapManEx - Capital Maintenance Expenditure

CoC - Cost of Capital

COIs - Catalog of Open Infrastructure services

MDG - Millennium Development Goals

ODA - Official Development Assistance

OECD - Organisation for Economic Co-operation and Development

OpEx - Operational and minor maintenance expenditure

SDM - Service Delivery Model

SFP - Strategic Financial Planning

SR - Scholarship and Research

WASH - Water, Sanitation, and Hygiene

WHO - World Health Organization

WSS - Water Sanitation and Supply

References

- Abrams, L., Palmer, I., & Hart, T. (1998). Sustainability Management Guidelines (p. 22). Department of Water Affairs and Forestry, South Africa.
- Brikke, F., & Rojas, J. (2001). Key factors for sustainable cost recovery in the context of community-managed water supply: Vol. no. 32-E (pp. vi, 71 p. : 7 boxes, 2 fig., 15 tabs.). IRC.
<https://www.ircwash.org/sites/default/files/Brikke-2001-Key.pdf>
- Cardone, R., & Fonseca, C. (2003). Financing and Cost Recovery. IRC.
<https://www.ircwash.org/resources/financing-and-cost-recovery>
- Danert, K., & Hutton, G. (2020). Shining the spotlight on household investments for water, sanitation and hygiene (WASH): Let us talk about HI and the three 'T's. *Journal of Water, Sanitation and Hygiene for Development*, 10(1), 1–4.
<https://doi.org/10.2166/washdev.2020.139>
- Fonseca, C., Franceys, R., Batchelor, C., McIntyre, P., Klutse, A., Komives, K., Moriarty, P. B., Naafs, A., Nyarko, K., Pezon, C., Potter, A., Reddy, R., & Snehalatha, M. (2011). Life-cycle costs approach: Costing sustainable services. IRC.
https://www.ircwash.org/sites/default/files/briefing_note_1a_-_life-cycle_cost_approach.pdf
- Libey, A., Adank, M., & Thomas, E. (2020). Who pays for water? Comparing life cycle costs of water services among several low, medium and high-income utilities. *World Development*, 136, 105155.
<https://doi.org/10.1016/j.worlddev.2020.105155>
- McNeill, D. (1998), Water as an economic good. *Natural Resources Forum*, 22: 253-261. <https://doi.org/10.1111/j.1477-8947.1998.tb00735.x>
- OECD. (2009a). *Managing Water for All: An OECD Perspective on Pricing and Financing* - OECD. OECD.
<https://www.oecd.org/greengrowth/sustainable-agriculture/44476961.pdf>
- OECD. (2009b). *Strategic Financial Planning for Water Supply and Sanitation*. OECD.
<https://www.oecd.org/environment/resources/43949580.pdf>
- OECD. (2019). *Making Blended Finance Work for SDG 6: Unlocking Commercial Finance for Water and Sanitation*. OECD. <https://doi.org/10.1787/5efc8950-en>

WHO. (2017). UN-Water GLAAS Trackfin Initiative: Tracking financing to sanitation, hygiene and drinking-water at national level.

<https://apo.who.int/publications/i/item/9789241513562>

WHO. (2018). *WHO WASH strategy 2018-2025*. Retrieved September 5, 2022, from

<https://www.who.int/publications-detail-redirect/WHO-CED-PHE-WSH-18.03>